

PATENT

Atty. Docket No. NNM-001

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

APPLICANTS: Mayes and Tyler  
SERIAL NUMBER: 09/308,166 GROUP NUMBER: 2754  
FILING DATE: June 25, 1999 EXAMINER: Not Yet Assigned  
TITLE: *Magnetizable Device*

**CERTIFICATE OF FACSIMILE AND EXPRESS MAILING**

I hereby certify that this correspondence and any document(s) referred to as attached hereto is being transmitted to Ms. Patricia Booker at the U. S. Patent and Trademark Office via facsimile (1-703-746-6695) and deposited with the United States Postal Service as Express Mail (Label No. **EL956539515US**), addressed to: Box PCT, Commissioner of Patents, Washington, DC 20231, ATTN: Ms. Patricia Booker, on June 19, 2002.

Date

*June 19, 2002*

Brenda T. Kowalczyk

*Brenda T. Kowalczyk*

Box PCT  
Commissioner for Patents  
Washington, D.C. 20231  
Attn: Ms. Patricia Booker

Sir:

Submitted herewith is/are:

Transmittal Form (1 pg.); Letter to Office of PCT Operations (3 pgs.);  
Exhibit A (1 pg.); Exhibit B (2 pgs.); Exhibit C (1 pg.); Exhibit D (1 pg.);  
Exhibit E (4 pgs.); Exhibit F (10 pgs.); Associate Power of Attorney (1  
pg.); and a postcard.

# TRANSMITTAL FORM

Application Serial Number	09/308,166
Filing Date	June 25, 1999
First Named Inventor	Mayes
Group Art Unit	2754
Examiner Name	Not yet assigned
Attorney Docket No.	NNM-001
Patent No.	Not applicable
Issue Date	Not applicable

## ENCLOSURES (check all that apply)

<input type="checkbox"/> Fee Transmittal Form <input type="checkbox"/> Check Attached <input type="checkbox"/> Copy of Fee Transmittal Form  <input type="checkbox"/> Amendment and Response <input type="checkbox"/> Preliminary <input type="checkbox"/> After Final <input type="checkbox"/> Affidavits/declaration(s) <input type="checkbox"/> Letter to Official Draftsperson including Drawings [Total Sheets ____]  <input type="checkbox"/> Petition for Extension of Time  <input type="checkbox"/> Information Disclosure Statement <input type="checkbox"/> Form PTO-1449 <input type="checkbox"/> Copies of IDS Citations  <input type="checkbox"/> Certified Copy of Priority Document(s)  <input type="checkbox"/> Sequence Listing submission <input type="checkbox"/> Paper Copy/CD <input type="checkbox"/> Computer Readable Copy <input type="checkbox"/> Statement verifying identity of above	<input type="checkbox"/> Copy of Notice to File Missing Parts of Application (PTO-1553)  <input type="checkbox"/> Formal Drawings  <input type="checkbox"/> Request For Continued Examination (RCE) Transmittal <input checked="" type="checkbox"/> Associate Power of Attorney  <input type="checkbox"/> Terminal Disclaimer  <input type="checkbox"/> Executed Declaration and Power of Attorney for Utility or Design Patent Application  <input type="checkbox"/> Small Entity Statement  <input type="checkbox"/> CD(s) for large table or computer program  <input type="checkbox"/> Amendment After Allowance  <input type="checkbox"/> Request for Certificate of Correction <input type="checkbox"/> Certificate of Correction (in duplicate)	<input type="checkbox"/> Notice of Appeal to Board of Patent Appeals and Interferences  <input type="checkbox"/> Appeal Brief (in triplicate)  <input type="checkbox"/> Status Inquiry <input checked="" type="checkbox"/> Return Receipt Postcard <input type="checkbox"/> Certificate of First Class Mailing under 37 C.F.R. 1.8 <input checked="" type="checkbox"/> Certificate of Facsimile and Express Mailing <input checked="" type="checkbox"/> Additional Enclosure(s) (please identify below)  1. Letter to Office of PCT Operations 2. Exhibits A-F
---	--	---

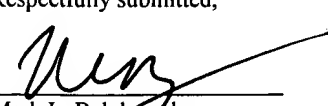
### CORRESPONDENCE ADDRESS

Direct all correspondence to: Patent Administrator  
 Testa, Hurwitz & Thibault, LLP  
 High Street Tower  
 125 High Street  
 Boston, MA 02110  
 Tel. No.: (617) 248-7000  
 Fax No.: (617) 248-7100

### SIGNATURE BLOCK

Date: June 19, 2002  
 Reg. No. 50,773  
 Tel. No.: (617) 248-7453  
 Fax No.: (617) 248-7100

Respectfully submitted,

  
 Mark L. Beloborodov  
 Attorney for Applicants  
 Testa, Hurwitz & Thibault, LLP  
 High Street Tower  
 125 High Street  
 Boston, MA 02110

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

APPLICANTS: Mayes and Tyler

SERIAL NUMBER: 09/308,166      GROUP NUMBER: 2754

FILING DATE: June 25, 1999      EXAMINER: Not Yet Assigned

TITLE: *Magnetizable Device*

Box PCT  
Commissioner of Patents  
Washington, DC 20231  
Attn: Ms. Patricia Booker

**LETTER TO OFFICE OF PCT OPERATIONS**

1. On November 17, 1997, Applicants filed an international patent application claiming priority to Great Britain Patent Application Serial No. 9623851.4, which was filed on November 16, 1996. The international application was assigned International Application No. **PCT/GB97/03152**.
2. On May 28, 1998, International Application No. **PCT/GB97/03152** was published under PCT Article 21(2) in the English language as International Publication No. WO98/22942. A copy of the title page of the published international application is attached hereto as Exhibit A.
3. On May 14, 1999, Applicants requested entry for International Application No. **PCT/GB97/03152** into the U.S. national stage under 35 U.S.C. §371. The May 14, 1999 submission included a Transmittal Letter for a PCT International Application Entering the National Stage in the US as a Designated or Elected Office under 35 U.S.C. §371, a copy of the International Search Report, a copy of the International Preliminary Examination Report, and a check for \$1,200. A copy of the Transmittal Letter, referencing International Application No. **PCT/GB97/03152**, is attached hereto as Exhibit B.
4. On June 11, 1999, the U.S. Patent and Trademark Office mailed to the Applicants' representative a Notification of Missing Requirements under 35 U.S.C. §371, indicating that copies of International Application No. **PCT/GB97/03152**, the International Search Report, the International Preliminary Examination Report, and the priority document had been received from either Applicants or the International Bureau of the PCT. The Notification of Missing Requirements incorrectly referenced the international patent application as International Application No. PCT/GB97/03512. A copy of the Notification of Missing Requirements is attached hereto as Exhibit C.
5. On June 25, 1999, in response to the Notification of Missing Requirements, Applicants fulfilled the requirements of 35 U.S.C. §371 by submitting an executed Declaration (along with the required fee), which properly referenced the international patent application as International Application No. **PCT/GB97/03152**.
6. On August 11, 2000, the U.S. Patent and Trademark Office mailed to the Applicants' representative a Notification of Acceptance of Application for national patentability examination, which correctly referenced the international patent application as International Application No. **PCT/GB97/03152**. A copy of the Notification of Acceptance is attached hereto as Exhibit D.

7. On September 1, 2000, the Office of Initial Patent Examination issued a Filing Receipt for the national stage of the international patent application, which, in the Continuing Data as Claimed by Applicant section, correctly stated, "This Application is a 371 of PCT/GB97/03152 11/17/97" (emphasis added). Corrected versions of the Filing Receipt were issued per Applicants' requests on October 6, 2000, and February 26, 2001, each containing the same proper Continuing Data as Claimed by Applicant entry. A copy of the Corrected Filing Receipt dated February 26, 2001, is attached hereto as Exhibit E.
8. On December 4, 2000, Applicants submitted a Preliminary Amendment along with a Power of Attorney and Revocation of Prior Powers form, requesting that all future correspondence be addressed to:  

Patent Administrator,  
Testa, Hurwitz & Thibault, LLP  
High Street Tower  
125 High Street  
Boston, MA 02110
9. On June 13, 2001, the Applicants' representative submitted a Status Inquiry form along with a Request to Correct Attorney of Record, resubmitting the Power of Attorney and Revocation of Prior Powers form initially filed on December 4, 2000, with the Preliminary Amendment. No response to the Status Inquiry has been received.
10. On June 14, 2002, following a conversation with a customer service representative at the PCT Help Desk, the undersigned attorney contacted Ms. Patricia Booker of the Office of PCT Operations who indicated that the national stage application, i.e. U.S. Serial No. 09/308,166, had not yet been forwarded for patentability examination and was marked for "troubleshooting," because there was a discrepancy in the PCT Serial Number. Specifically, Ms. Booker stated that the U.S. Serial No. 09/308,166, assigned to the above-identified international patent application following its entry into the national stage in the U.S., as indicated in the Filing Receipt, was allegedly associated with two international applications, International Application Nos. PCT/GB97/03512 and PCT/GB97/03152.
11. Ms. Booker requested that the undersigned attorney fax her a statement confirming the proper International Application Number of the international patent application. She indicated that upon receipt of such statement, she would rectify the discrepancy in the records of the U.S. Patent and Trademark Office and would promptly forward the above-identified national stage patent application to the Office of PCT Legal Administration for further processing.
12. Ms. Booker also indicated that neither the Power of Attorney and Revocation of Prior Powers form filed on December 4, 2000, nor the June 13, 2001 submission, was in the application file and requested that the undersigned attorney resubmit that submission so that the change in the attorney of record and the correspondence address could be processed. A copy of the June 13, 2001 submission is attached hereto as Exhibit F.
13. Per Ms. Booker's request, Applicants confirm that the proper International Application Number for the international patent application in question is PCT/GB97/03152. Applicants further state that the International Application No. PCT/GB97/03512 (now U.S. Patent No. 6,348,203, issued February 19, 2002, to Goodman *et al.*) was not filed by Applicants and is not related in any way to International Application No. PCT/GB97/03152.
14. Accordingly, in light of the substantial delay in processing of the above-identified national stage patent application, which occurred through no fault of Applicants, Applicants respectfully request expedited handling of this matter.

15. Applicants understand that this application is presently in good standing, is not abandoned, and in condition for examination.
16. Applicants note that U.S. Patent Application Serial No. 09/730,117, which is a continuation of the above-identified national stage patent application, already has been transferred to Group 1773 for examination and is assigned to Examiner Resan. To expedite prosecution of these related applications, Applicants respectfully request that the above-identified national stage patent application also be assigned to Examiner Resan in Group 1773.
17. Applicants believe that no fee is due upon filing of this submission. However, should any fee be required, the Director is authorized to charge Deposit Account No. 20-0531 for the required fee.

Respectfully submitted,



---

Mark L. Beloborodov, Reg. No. 50,773  
Attorney for Applicants  
Testa, Hurwitz, & Thibeault, LLP  
High Street Tower  
125 High Street  
Boston, Massachusetts 02110

Date: June 19, 2002

Tel. No. (617) 248-7453  
Fax: (617) 248-7100

2428280

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau

## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : <b>G11B 5/712, 5/62</b>	<b>A1</b>	(11) International Publication Number: <b>WO 98/22942</b> (43) International Publication Date: <b>28 May 1998 (28.05.98)</b>
(21) International Application Number: <b>PCT/GB97/03152</b> (22) International Filing Date: <b>17 November 1997 (17.11.97)</b> (30) Priority Data: <b>9623851.4</b> ✓ <b>16 November 1996 (16.11.96)</b> ✓ <b>GB</b> (71)(72) Applicants and Inventors: <b>MAYES, Eric, Leigh</b> ✓ <b>{US/GB}; 5 Brock Street, Bath BA1 26N (GB). TYLER,</b> ✓ <b>Malvin, Nicolas [GB/GB]; 9 The Circus, Bath BA1 2EW</b> ✓ <b>(GB).</b> (74) Agent: <b>NASH, David, Allan; Haseltine Lake &amp; Co., Imperial</b> <b>House, 15-19 Kingsway, London WC2B 6UD (GB).</b>	(81) Designated States: <b>AL, AM, AT, AU, AZ, BA, BB, BG, BR,</b> <b>BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE,</b> <b>GH, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK,</b> <b>LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO,</b> <b>NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR,</b> <b>TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH,</b> <b>KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ,</b> <b>BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE,</b> <b>CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL,</b> <b>PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN,</b> <b>ML, MR, NE, SN, TD, TG).</b>  Published ✓ <i>With international search report.</i>	
(54) Title: <b>MAGNETIZABLE DEVICE</b> ✓ (57) Abstract ✓  <p>There is disclosed a magnetic recording medium which includes a magnetizable layer thereon, wherein said magnetizable layer comprises a plurality of ferri- or ferromagnetic particles each having a largest dimension no greater than 100nm, and each of which particles represents a separate ferromagnetic domain.</p>		

EXHIBIT B

**TRANSMITTAL LETTER FOR A PCT INTERNATIONAL APPLICATION**  
**ENTERING THE NATIONAL STAGE IN THE U.S.**  
**AS A DESIGNATED or ELECTED OFFICE UNDER 35 USC 371**

Attorney's Docket No.: HASLP003

Date: May 14, 1999

Express Mail" mailing label number (from mail label): EL243914071

Express Mail No. EL956539515US

Date of Deposit: May 14, 1999

I hereby certify that this paper is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service, as required under 37 CFR 1.10, on the date indicated above and is addressed to the Assistant Commissioner for Patents, Box PCT Application, Washington, D.C. 20231.

Name:

Dionna Holmes

Signature:

Dionna Holmes

BEYER & WEAVER, LLP

Assistant Commissioner for Patents  
Box PCT Application  
Washington, D.C. 20231

Attention: DO/EO/US

U.S.: ☒ FOREIGN: ☐  
DOCKETED: 5-18-99 BY: SE  
ACTION: \_\_\_\_\_  
FEE DATES: \_\_\_\_\_  
BY: JEW DOCKET# \_\_\_\_\_  
JEH

Transmitted herewith are the papers required to enter the national state in the U.S. as a designated office/elected office for the following PCT international patent application:

**INTERNATIONAL APPLICATION NUMBER: PCT/GB97/03152**

**Int'l Filing Date: 17 November 1997**

**1st Priority Date: 16 November 1996**

**Inventor(s): MAYES, Eric, Leigh  
TYLER, Malvin, Nicolas**

**For: MAGNETIZABLE DEVICE**

The United States Patent Office is: (select one)

☐ A Designated Office (No Demand was filed - See 37 CFR 1.494)

☒ An Elected Office (A Demand for Preliminary Examination was Filed - See 37 CFR 1.495)

Enclosed are:

- ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
- ☐ A copy of the international application (if this line is not checked, the international application was previously communicated by the International Bureau or the international application was originally filed in the USPTO).
- ☐ An English Translation of the International Application
- ☐ A Combined Declaration and Power of Attorney
- ☐ A copy of amendments made under PCT Article 19
- ☐ A translation of amendments made under PCT Article 19
- ☐ A translation of annexes to the international preliminary examination report
- ☐ Verified Statement establishing Small Entity Status under 37 CFR 1.9 and 1.27.
- ☐ An Assignment of the Invention to: \*\*\*.  
(with \$40.00 recordal fee)
- ☐ Information Disclosure Statement

- ☐ A Preliminary Amendment  
☒ A copy of the International Search Report  
☒ A copy of the Preliminary Examination Report  
☒ A check to cover the filing fees (including the basic national fee under 37 CFR 1.492(a)) in the amount calculated below:

#### FEE CALCULATION

<input checked="" type="checkbox"/>	BASIC FEE	\$930
	(IPEA-U.S. \$720/360; ISA-U.S. \$790/395; PTO not ISA or IPEA \$1070/535;	
	U.S. IPEA all claims meet 33(2)-(4) \$98/49; File w/ EPO or JPO search report \$930/465;)	
<input type="checkbox"/>	Surcharge for filing a late oath or declaration (\$130/65)	\$ ***
<input type="checkbox"/>	Surcharge for filing a late translation (\$130)	\$ ***
<input checked="" type="checkbox"/>	Multiple dependent claims (\$270/135)	\$ 270
<input type="checkbox"/>	Excess claims - see calculation below	\$ ***
	Total Claims: 16 - 20 = 0	X \$22/11 claim = \$ -0-
	Independent Claims: 2 - 3 = 0	X \$82/41 ind. claim = \$ -0-
	Excess Claim Total	\$ -0-
<input type="checkbox"/>	Assignment recordal fee (\$40)	\$ ***
	<b>TOTAL FEES</b>	<b>\$1200</b>

Please direct any correspondence to:

**Customer Number: 022434**  
 BEYER & WEAVER, LLP  
 P.O. Box 61059  
 Palo Alto, CA 94306



**22434**

PATENT TRADEMARK OFFICE

☒ The Commissioner is hereby authorized to charge any additional fees or credit any overpayment to Deposit Account No. 50-0388. A duplicate copy of this transmittal is enclosed.

Respectfully submitted.

*Joseph M. Villeneuve*

Joseph M. Villeneuve  
 Registration No. 37,460

BEYER & WEAVER, LLP  
 P.O. BOX 61059  
 Palo Alto, CA 94306  
 (650) 493-2100





U.S. APPLICATION NO.	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
09/308166	MAYES	E HASLP003

BEYER & WEAVER LLP  
P O BOX 61059  
PALO ALTO, CA 94306

INTERNATIONAL APPLICATION NO.	
PCT/GB97/03512	
I.A. FILING DATE	PRIORITY DATE
17 NOV 97	16 NOV 96
DATE MAILED: <i>11-11-99</i>	

**NOTIFICATION OF MISSING REQUIREMENTS UNDER 35 U.S.C. 371 IN THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US)**

1. The following items have been submitted by the applicant or the IB to the United States Patent and Trademark Office as

- ☐ a Designated Office (37 CFR 1.494),  
☒ an Elected Office (37 CFR 1.495):  
☒ U.S. Basic National Fee.  
☒ Copy of the international application in:  
☐ a non-English language.  
☒ English.

- ☐ Translation of the international application into English.  
☐ Oath or Declaration of inventors(s) for DO/EO/US.  
☐ Copy of Article 19 amendments.  
☐ Translation of Article 19 amendments into English.  
☒ The International Preliminary Examination Report in English and its Annexes, if any.  
☐ Translation of Annexes to the International Preliminary Examination Report into English.  
☐ Preliminary amendment(s) filed \_\_\_\_\_ and \_\_\_\_\_.  
☐ Information Disclosure Statement(s) filed \_\_\_\_\_ and \_\_\_\_\_.  
☐ Assignment document.  
☐ Power of Attorney and/or Change of Address.  
☐ Substitute specification filed \_\_\_\_\_.  
☐ Verified Statement Claiming Small Entity Status.  
☒ Priority Document.  
☒ Copy of the International Search Report ☒ and copies of the references cited therein.  
☐ Other:

2. The following items **MUST** be furnished within the period set forth below in order to complete the requirements for acceptance under 35 U.S.C. 371:

- ☐ a. Translation of the application into English. Note a processing fee will be required if submitted later than the appropriate 20 or 30 months from the priority date.  
☐ The current translation is defective for the reasons indicated on the attached Notice of Defective Translation.  
☐ b. Processing fee for providing the translation of the application and/or the Annexes later than the appropriate 20 or 30 months from the priority date (37 CFR 1.492(f)).  
☒ c. Oath or declaration of the inventors, in compliance with 37 CFR 1.497(a) and (b), identifying the application by the international application number and international filing date.  
☐ The current oath or declaration does not comply with 37 CFR 1.497(a) and (b) for the reasons indicated on the attached PCT/DO/EO/917.  
☒ d. Surcharge for providing the oath or declaration later than the appropriate 20 or 30 months from the priority date (37 CFR 1.492(e)).

3. Additional claim fees of \$ \_\_\_\_\_ as a ☐ large entity ☐ small entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due. See attached PTO-875.

**ALL OF THE ITEMS SET FORTH IN 2(a)-2(d) AND 3 ABOVE MUST BE SUBMITTED WITHIN ONE MONTH FROM THE DATE OF THIS NOTICE OR BY ☐ 21 OR ☒ 31 MONTHS FROM THE PRIORITY DATE FOR THE APPLICATION, WHICHEVER IS LATER. FAILURE TO PROPERLY RESPOND WILL RESULT IN ABANDONMENT.**

The time period set above may be extended by filing a petition and fee for extension of time under the provisions of 37 CFR 1.136(a).

4. Translation of the Annexes **MUST** be submitted no later than the time period set above or the annexes will be cancelled. Note processing fee will be required if submitted later than 30 months from the priority date.  
 5. ☐ The Article 19 amendments are cancelled since a translation was not provided by the appropriate 20 (37 CFR 494(d)) or 30 (37 CFR 1.495(d)) months from the priority date.

Applicant is reminded that any communication to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above. (37 CFR 1.5)

**A copy of this notice MUST be returned with this response.**

Enclosed:

- ☐ PCT/DO/EO/917 ☐ Notice of Defective Translation  
☐ PTO-875  
 FORM PCT/DO/EO/905 (December 1997)

COTTMAN, DARRELL C

Telephone: (703) 305-3693



UNITED STATES DEPARTMENT OF COMMERCE  
Patent and Trademark Office  
Address: ASSISTANT COMMISSIONER FOR PATENTS  
Washington, D.C. 20231

09/308166

U.S. APPLICATION NO.	MAYES	ATTY. DOCKET NO.	HASLB003
022434	5071	INTERNATIONAL APPLICATION NO.	PCT/US97/03152
BEYER WEAVER & THOMAS LLP		LA. FILING DATE	11/17/97
P O BOX 130		PRIORITY DATE	11/16/96
MOUNTAIN VIEW CA 94042-0130		DATE MAILED:	08/14/00

**NOTIFICATION OF ACCEPTANCE OF APPLICATION UNDER 35 U.S.C. 371  
AND 37 CFR 1.494 OR 1.495**

1. The applicant is hereby advised that the United States Patent and Trademark Office in its capacity as ☐ a Designated Office (37 CFR 1.494), ☒ an Elected Office (37 CFR 1.495), has determined that the above identified international application has met the requirements of 35 U.S.C. 371, and is **ACCEPTED** for national patentability examination in the United States Patent and Trademark Office.

2. The United States Application Number assigned to the application is shown above and the relevant dates are:

25 June 2000  
35 U.S.C. 102(e) DATE

25 June 2000  
DATE OF RECEIPT OF  
35 U.S.C. 371 REQUIREMENTS

A Filing Receipt (PTO-103X) will be issued for the present application in due course. **THE DATE APPEARING ON THE FILING RECEIPT AS THE "FILING DATE" IS THE DATE ON WHICH THE LAST OF THE 35 U.S.C. 371(C) REQUIREMENTS HAS BEEN RECEIVED IN THE OFFICE. THIS DATE IS SHOWN ABOVE.** The filing date of the above identified application is the international filing date of the international application (Article 11(3) and 35 U.S.C. 363). Once the Filing Receipt has been received, send all correspondence to the Group Art Unit designated thereon.

3. ☒ A request for immediate examination under 35 U.S.C. 371(f) was received on 14 May 1999 and the application will be examined in turn.

4. The following items have been received:

- ☒ U.S. Basic National Fee.
- ☒ Copy of the international application in:
  - ☐ a non-English language.
  - ☒ English.
- ☐ Translation of the international application into English.
- ☒ Oath or Declaration of inventor(s) for DO/EO/US.
- ☐ Copy of Article 19 amendments. ☐ Translation of Article 19 amendments into English.  
The Article 19 amendments ☐ have ☐ have not been entered.
- ☒ The International Preliminary Examination Report in English and its Annexes, if any.
- ☐ Copy of the Annexes to the International Preliminary Examination Report (IPER).  
☐ Translation of Annexes to the IPER into English.  
The Annexes ☐ have ☐ have not been entered.
- ☐ Preliminary amendment(s) filed \_\_\_\_\_ and \_\_\_\_\_.
- ☐ Information Disclosure Statement(s) filed \_\_\_\_\_ and \_\_\_\_\_.
- ☐ Assignment document.
- ☐ Power of Attorney and/or Change of Address.
- ☐ Substitute specification filed \_\_\_\_\_.
- ☒ Verified Statement Claiming Small Entity Status.
- ☒ Priority Document.
- ☒ Copy of the International Search Report ☒ and copies of the references cited therein.
- ☐ Other:



JKW / JKW

Applicant is reminded that any communication to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above. (37 CFR 1.5)

FORM PCT/DO/EO/903 (December 1997)

Telephone: 703

Patricia Booker  
National Stage Processing  
Patent Specialist  
(703) 305-8788

**PCT**WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau

## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>6</sup>:</b> <b>G11B 5/712, 5/62</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 98/22942</b> <b>(43) International Publication Date:</b> 28 May 1998 (28.05.98)
<b>(21) International Application Number:</b> PCT/GB97/03152 <b>(22) International Filing Date:</b> 17 November 1997 (17.11.97) <b>(30) Priority Data:</b> 9623851.4 16 November 1996 (16.11.96) GB <b>(71)(72) Applicants and Inventors:</b> MAYES, Eric, Leigh [US/GB]; 5 Brock Street, Bath BA1 26N (GB). TYLER, Malvin, Nicolas [GB/GB]; 9 The Circus, Bath BA1 2EW (GB). <b>(74) Agent:</b> NASH, David, Allan; Haseltine Lake & Co., Imperial House, 15-19 Kingsway, London WC2B 6UD (GB).		<b>(81) Designated States:</b> AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i>
<b>(54) Title:</b> MAGNETIZABLE DEVICE  <b>(57) Abstract</b>  Theres is disclosed a magnetic recording medium which includes a magnetizable layer thereon, wherein said magnetizable layer comprises a plurality of ferri- or ferromagnetic particles each having a largest dimension no greater than 100nm, and each of which particles represents a separate ferromagnetic domain.		

-1-

**MAGNETIZABLE DEVICE**

This invention relates to a magnetizable device which comprises a magnetic layer composed of domain-separated, nanoscale (e.g. 1-100nm) ferromagnetic particles. The magnetizable device of the invention may be used as a magnetic storage device having improved data storage characteristics. In particular, the invention relates to magnetic storage media comprising single-domain, domain-separated, uniform, ferromagnetic nanoscale (e.g. 1-100 nm) particles which may be arranged into a regular 2-D packed array useful in the storage of information.

Among the possible pathways to ultrahigh-density ( $\geq 1$  Gbit/in<sup>2</sup>) magnetic media is the use of nanoscale (1-100 nm) particles. Beyond the standard requirements for magnetic media, a viable particulate media should have a small standard deviation in particle size as well as the particles being exchange decoupled. These requirements are necessary to avoid adverse media noise. Current methods of fabricating nanoscale particles, such as arc-discharge or multiple target ion-beam sputtering, have not fully addressed these two requirements. Moreover, if the uniform particles are arranged into an ordered array, each particle can represent a "bit" of information at a predictable location further increasing the media's efficiency. This invention details methods of producing particulate media that meet these requirements for ultrahigh-density recording. This invention is also an open system which allows for the production of a variety of magnetic materials, such that the media can be tuned for different applications.

In particular this invention details the use of an iron storage protein, ferritin, whose internal cavity is used to produce the nanoscale particles. Ferritin is utilised in iron metabolism throughout living

species and its structure is highly conserved among them. It consists of 24 subunits which are arranged to provide a hollow shell roughly 8 nm in diameter. The cavity normally stores 4500 iron(III) atoms in the form of paramagnetic ferrihydrite. However, this ferrihydrite can be removed (a ferritin devoid of ferrihydrite is termed "apoferritin") and other materials may be incorporated. Examples include ceramics, superparamagnetic magnetite, acetaminophen, and even the sweetener aspartame. To address magnetic media concerns, the invention incorporates ferromagnetically ordered materials.

According to a first aspect of the present invention, there is provided a magnetizable device which comprises a magnetic layer composed of domain-separated, ferromagnetic particles each of which has a largest dimension no greater than 100nm.

According to a second aspect of the invention, there is provided a magnetic recording medium which includes a magnetizable layer, wherein said magnetizable layer comprises a plurality of ferromagnetic particles each having a largest dimension no greater than 100nm, and each of which particles represents a separate ferromagnetic domain. The magnetizable layer is preferably supported on a non-magnetic substrate.

According to a third aspect of the present invention, there is provided a magnetic composition comprising a plurality of ferromagnetic particles each of which is bound to an organic macromolecule, and each of which has a largest dimension no greater than 100nm. In this aspect of the invention, it is preferred that said organic macromolecule is ferritin from which the normal core ferrihydrite has been removed and replaced by a ferromagnetic particle.

As used herein, the term "ferromagnetic" embraces

materials which are either "ferromagnetic" and "ferrimagnetic". Such usage is common in the electrical engineering art.

The ferromagnetic particles used in the invention  
5 should be of a material and size such that they possess ferromagnetic properties at ambient temperatures (e.g. 15°C to 30°C),

Preferably, the ferromagnetic particles each have a largest dimension no greater than 50nm, more  
10 preferably less than 25nm and most preferably smaller than 15nm. The largest dimension of the ferromagnetic particles should not be so small that the particle will lose its ferromagnetic property and become  
superparamagnetic at the desired operating temperature  
15 of the recording medium. Typically, for operation at ambient temperature, this means that the magnetic particles will normally be no smaller than about 3nm in their largest diameter.

In the magnetizable device of the first aspect of  
20 this invention and the magnetic recording medium of the second aspect of this invention, the distance between adjacent ferromagnetic domains is preferably as small as possible to permit the maximum number of discrete domains in a given area, and provide the maximum  
25 storage capacity for the recording medium. The actual lower limit will vary for different materials and other conditions such as the temperature at which the recording medium is to be used. The key requirement, however, is that neighbouring domains should not be  
30 able to interfere magnetically with each other to the extent that the magnetic alignment of any domain can be altered by neighbouring domains. Typically, the lower limit on the spacing of the domains is about 2nm. The distance between adjacent domains will be determined by  
35 the density of discrete domains required. Typically, however, to take advantage of the miniaturization

possibilities provided by the invention, the distance between adjacent domains will be no greater than 10nm.

Generally the particles will be uniform in size, by which we mean that the particles do not vary in largest diameter by more than about 5%. One of the advantages of the use in the invention of an organic macromolecule which binds a magnetic particle by surrounding it is that this can be used to select particles of a uniform size.

10 In the case where the particles are spheroidal, it will be the diameter of the particles which must be no greater than 100nm.

In preferred embodiments of all aspects of this invention, each ferromagnetic particle is encased, or partially encased, within an organic macromolecule. The term macromolecule means a molecule, or assembly of molecules, and may have a molecular weight of up to 1500kD, typically less than 500kD. Ferritin has a molecular weight of 400kD.

20 The macromolecule should be capable of binding by encasing or otherwise organising the magnetic particle, and may therefore comprise a suitable cavity capable of containing the particle; a cavity will normally be fully enclosed within the macromolecule.

25 Alternatively, the macromolecule may include a suitable opening which is not fully surrounded, but which nevertheless is capable of receiving and supporting the magnetic particle; for example, the opening may be that defined by an annulus in the macromolecule. For

30 example, suitable macromolecules which may be used in the invention are proteins, for example the protein apoferritin (which is ferritin in which the cavity is empty), flagellar L-P rings, cyclodextrins, self-assembled cyclic peptides. As an alternative to

35 encasing the magnetic particles within the macromolecule, they may be organised on the

macromolecule, such as on a bacterial S-layer.

Other materials which may be used in the invention to organise the ferromagnetic particles are inorganic-silica networks such as MCM type materials, dendrimers  
5 and micellar type systems.

The presently preferred macromolecule for use in the invention is the apoferritin protein which has a cavity of the order of 8nm in diameter. The ferri- or ferromagnetic particles to be accommodated within this  
10 protein should have a diameter no greater than 8nm.

The bound particles of this aspect of the present invention with a coating that inhibits aggregation and oxidation, also helping them to be domain-separated.

In the magnetizable device of the first aspect of  
15 this invention and the magnetic recording medium of the second aspect of this invention, the particles are preferably arranged in a 2-D ordered array which would yield an ultrahigh-density magnetic media.

The ferromagnetic material may be a metal, such as  
20 cobalt, iron, or nickel; a metal alloy, such as an alloy which contains aluminium, barium, bismuth, cerium, chromium, cobalt, copper, iron, manganese, molybdenum, neodymium, nickel, niobium, platinum, praseodymium, samarium, strontium, titanium, vanadium,  
25 ytterbium, yttrium or a mixture thereof; a metal ferrite such as a ferrite containing barium, cobalt, or strontium; or an organic ferromagnetic material.

When generating nanoscale particles, one major concern is that the particles produced are not  
30 superparamagnetic. Superparamagnetic particles are those which have permanent magnetic dipole moments, but the moments' orientations with respect to the crystallographic axes fluctuate with time. This is not useful for a practical magnetic storage media.  
35 Superparamagnetism depends on the volume, temperature, and anisotropy of the particles. Via energy



-6-

considerations, one can derive an equation relating these quantities. The volume at which a particle becomes superparamagnetic ( $V_p$ ) is given by:  $V_p = 25kT/K$ , where  $k$  is Boltzman's constant,  $T$  the temperature of the particle in degrees Kelvin, and  $K$  the anisotropy constant of the material. Using this formula, it is possible to determine the temperature at which a particle becomes superparamagnetic (the "blocking temperature") for a given material at a fixed volume. In our specific case, the fixed volume is 8 nm in ferritin. If a cobalt metal particle with only crystalline anisotropy (that value being  $45 \times 10^5$ ) is a sphere with a diameter of 8 nm, the blocking temperature is 353 °K. This is within the range of temperatures experienced within a hard disk drive, and the cobalt particles may prove to be a useful storage medium. Obviously, there are other considerations such as the materials' coercivity, moment, saturation magnetisation, and relaxation time. By tuning the materials incorporated into the ferritin, though, these can be addressed.

Ferritin is utilised in iron metabolism throughout living species and its structure is highly conserved among them. It consists of 24 subunits arranged in a 432 symmetry which provide a hollow shell roughly 8 nm in diameter. The cavity normally stores 4500 iron(III) atoms in the form of paramagnetic ferrihydrite. However, this ferrihydrite can be removed (a ferritin devoid of ferrihydrite is termed "apoferritin") and other materials may be incorporated. The subunits in ferritin pack tightly, however there are channels into the cavity at the 3-fold and 4-fold axes. Lining the 3-fold channels are residues which bind metals such as cadmium, zinc, and calcium. By introducing such divalent ions one can potentially bind ferritin molecules together, or at least encourage their

proximal arrangement.

One method of preparing a 2-D packed array of ferromagnetically ordered particles of uniform size up to 8 nm includes the removal of the ferrihydrite core from the native ferritin in aqueous solution, the incorporation of ferromagnetically ordered cobalt metal particles by sodium borohydride reduction of the aqueous Co(II) solution into the ferritin cavities, the generation of a narrow size distribution through ultracentrifugation, the injection of particles into an MES/glucose subphase solution upon which the 2-D array assembles, and the transfer of the 2-D array to a substrate which is then carbon coated. In this method, the ferritin source may be a vertebrate, invertebrate, plant, fungi, yeast, bacteria, or one produced through recombinant techniques.

In the method described, a metal alloy core may be produced by sodium borohydride reduction of a water soluble metal salt. Other oxidation methods include carbon, carbon monoxide, hydrogen, or hydrazine hydrate solution. Alternatively, a suitable solution may be oxidised to yield a metal ferrite core. Oxidation may be chemical or electrochemical to yield the metal ferrite.

In this method, other methods of selecting a narrow size distribution may be employed such as short or long column meniscus depletion methods or magnetic field separation.

Further, in this method, divalent metal salts containing cadmium, calcium, or zinc may be added into the subphase solution to aid in particle ordering.

Further, in this, other methods of arranging the particles into a 2-D array may be employed, such as solution evaporation onto a solid substrate.

Further, in this method, the 2-D array may be coated with carbon-based films such as hydrogenated or

nitrogen doped diamond-like carbon, or with silicon-based films such as silicon dioxide.

In the present invention, ferritin may be used to enclose a ferromagnetic particle whose largest  
5 dimension is limited by ferritin's inner diameter of 8 nm. The particles are produced first by removing the ferrihydrite core to yield apoferritin. This is done by dialysis against a buffered sodium acetate solution under a nitrogen flow. Reductive chelation using  
10 thioglycolic acid is used to remove the ferrihydrite core. This is followed by repeated dialysis against a sodium chloride solution to completely remove the reduced ferrihydrite core from solution. Once the apoferritin is produced, ferri- or ferromagnetic  
15 particles are incorporated in the following ways. The first is by reducing a metal salt solution in the presence of apoferritin. This is performed in an inert atmosphere to protect the metal particles from oxidation which would lessen their magnetic benefit. A  
20 combination of metal salts in solution can also be reduced to generate alloys or alloy precursors. Sintering or annealing in a magnetic field may be necessary to generate the useful magnetic alloys. Another method is to oxidise a combination of an  
25 iron(II) salt and another metal salt. This gives a metal ferrite particle which does not suffer negatively from oxidation. The metal salts which are beneficial include salts of aluminium, barium, bismuth, cerium, chromium, cobalt, copper, iron, manganese, molybdenum,  
30 neodymium, nickel, niobium, platinum, praseodymium, samarium, strontium, titanium, vanadium, ytterbium, and yttrium.

A narrow size distribution of particles is necessary to avoid media noise. Such a distribution  
35 can be obtained through a variety of procedures including, but not limited to, density gradient

centrifugation or magnetic field separation.

While the production procedure detailed uses native horse spleen ferritin, this invention should not be seen as limited to that source. Ferritin can be  
5 found in vertebrates, invertebrates, plants, fungi, yeasts, bacteria, or even produced through recombinant techniques. By creating mutant apoferritins lacking the divalent binding site, others have found that the mutant proteins assemble into oblique assemblies as  
10 opposed to the regular hexagonal close-packed.

While ferritin seems to be an ideal system for generating nanoscale particles, it is not the only system available. For example, flagellar L-P rings are tubular proteins with an inner diameter of 13 nm. By  
15 creating a 2-D array of these proteins, metal films could be deposited into the tubular centres to create perpendicular rods of magnetic material. Also metal reduction in the presence of a microemulsion can be used to generate nanoscale particles which are coated  
20 with surfactant. This invention is open to other nanoscale particle production methods.

Finally an ordered arrangement of the particles is desired. One way to accomplish this is by injecting an aqueous solution of particles into an MES/glucose  
25 subphase solution contained in a Teflon trough. The particles spread at the air-subphase interface, and a portion denature to form a monolayer film. The 2-D arrangement of encased particles occurs underneath this monolayer. After 10 minutes at room temperature, the  
30 arrangement and monolayer are transferred to a substrate by placing the substrate directly onto the monolayer for 5 minutes. After withdrawing the substrate, the attached arrangement is coated with a thin layer of carbon for protection. Other methods  
35 such as solution evaporation onto a solid substrate can also give 2-D arrangements, and this invention should

-10-

not be seen as limited in its arrangement methods.

#### EXAMPLE 1

This example illustrates the preparation of apoferritin from horse spleen ferritin. Apoferritin  
5 was prepared from cadmium-free native horse spleen ferritin (CalBiochem, 100 mg/ml) by dialysis (molecular weight cut-off of 10-14 kDaltons) against sodium acetate solution (0.2 M) buffered at pH 5.5 under a nitrogen flow with reductive chelation using  
10 thioglycolic acid (0.3 M) to remove the ferrihydrite core. This is followed by repeated dialysis against sodium chloride solution (0.15 M) to completely remove the reduced ferrihydrite core from solution.

#### EXAMPLE 2

15 This example illustrates the preparation of cobalt metal within apoferritin. The apoprotein is added to a deaerated TES/sodium chloride solution (0.1/0.4 M) buffered at pH 7.5 to give an approximate 1 mg/ml working solution of the protein. A deaerated  
20 cobalt(II) [for example, as the acetate salt] solution (1 mg/ml) was added incrementally such that the total number of atoms added was approximately 500 atoms/apoprotein molecule. This was allowed to stir at room temperature for one day in an inert atmosphere.  
25 This is followed by reduction of the cobalt(II) salt with sodium borohydride to cobalt(0) metal. The final product yielded a solution of cobalt particles, each surrounded by a ferritin shell.

#### EXAMPLE 3

30 This example illustrates the preparation of a metal alloy such as yttrium cobalt ( $\text{YCo}_5$ ) within apoferritin. The metal alloy follows the same procedure as Example 2 but using a 1:5 ratio of yttrium(III) [for example, as the acetate salt] to cobalt(II) [for  
35 example, as the acetate salt]. The final product yielded a solution of yttrium cobalt particles, each

-11-

surrounded by a ferritin shell.

#### EXAMPLE 4

This example illustrates the preparation of a metal ferrite such as cobalt ferrite ( $\text{CoO} \cdot \text{Fe}_2\text{O}_3$ ) within apoferritin. The apoprotein is added to a deaerated MES/sodium chloride solution (0.1/0.4 M) buffered at pH 6 to give an approximate 1 mg/ml working solution of the protein. A deaerated solution of cobalt(II) [for example, as the acetate salt] and iron(II) [for example, as the ammonium sulphate salt] in a ratio of 1:2 is added incrementally and allowed to air-oxidise. The final product yielded a solution of cobalt ferrite particles, each surrounded by a ferritin shell.

#### EXAMPLE 5

This example illustrates the 2-D arrangement of ferritin-encased magnetic particles. An aqueous solution of particles [from Examples 2-4, and whose uniformity in size has been selected] is injected into an MES/glucose subphase solution (0.01 M/2%) contained in a Teflon trough. The particles spread at the air-subphase interface, and a portion denature to form a monolayer film. The 2-D arrangement of encased particles occurs underneath this monolayer. After 10 minutes at room temperature, the arrangement and monolayer are transferred to a substrate by placing the substrate directly onto the monolayer for 5 minutes. After withdrawing the substrate, the attached arrangement is coated with a thin layer of carbon for protection.

CLAIMS:

1. A magnetizable device which comprises a magnetic layer composed of domain-separated, ferromagnetic particles each of which has a largest  
5 dimension no greater than 100nm.
2. Magnetic recording medium which includes a magnetizable layer thereon, wherein said magnetizable layer comprises a plurality of ferromagnetic particles each having a largest dimension no greater than 100nm,  
10 and each of which particles represents a separate ferromagnetic domain.
3. Magnetic recording medium according to claim 2, wherein the distance between adjacent ferromagnetic domains is at least 2nm.
- 15 4. Magnetic recording medium according to claim 2 or 3, wherein the distance between adjacent ferromagnetic domains is no greater than 10nm.
5. Magnetic recording medium according to claim 1, 2, 3 or 4, wherein each ferromagnetic particle is  
20 encased within an organic macromolecule.
6. Magnetic recording medium according to claim 5, wherein each ferromagnetic particle is encased within the cavity or opening of a protein macromolecule.
- 25 7. Magnetic recording medium according to claim 6, wherein each ferri- or ferromagnetic particle is encased within an apoferritin protein.
8. A magnetic composition comprising a plurality of ferromagnetic particles each of which is bound to an  
30 organic macromolecule, and each of which ferromagnetic particles has a largest dimension no greater than 100nm.

EXHIBIT E

Express Mail No. EL956539515US



## UNITED STATES PATENT AND TRADEMARK OFFICE

COMMISSIONER FOR PATENTS  
UNITED STATES PATENT AND TRADEMARK OFFICE  
WASHINGTON, D.C. 20231  
www.uspto.gov

APPLICATION NUMBER	FILING DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	DRAWINGS	TOT CLAIMS	IND CLAIMS
09/308,166	06/25/1999	2754	615	HASLP003		32	2

CONFIRMATION NO. 5815

22434

BEYER WEAVER & THOMAS LLP  
P.O. BOX 778  
BERKELEY, CA 94704-0778

CORRECTED FILING RECEIPT



\*OC00000005797587\*

Date Mailed: 02/26/2001

Receipt is acknowledged of this nonprovisional Patent Application. It will be considered in its order and you will be notified as to the results of the examination. Be sure to provide the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION when inquiring about this application. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please write to the Office of Initial Patent Examination's Customer Service Center. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the PTO processes the reply to the Notice, the PTO will generate another Filing Receipt incorporating the requested corrections (if appropriate).

## Applicant(s)

Eric Leigh Mayes, Bath, GBN;  
Malvin Nicolas Tyler, Bath, GBN;

## Continuing Data as Claimed by Applicant

THIS APPLICATION IS A 371 OF PCT/GB97/03152 11/17/1997

## Foreign Applications

UNITED KINGDOM 9623851.4 11/16/1996

If Required, Foreign Filing License Granted 09/01/2000

Projected Publication Date:

Non-Publication Request: No

Early Publication Request: No

Title

Magnetizable Device

Preliminary Class

No Docketing Necessary

*TM*  
\_\_\_\_\_  
Administrator

3-20-01

Date

Reviewed &amp; Approved

*MLB*  
\_\_\_\_\_  
Resp. Atty

3-21-01

Date



**Data entry by : SHEFFEY, CATHERINE**

**Team : OIPE**

**Date: 02/26/2001**

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 1040 1

**LICENSE FOR FOREIGN FILING UNDER**  
**Title 35, United States Code, Section 184**  
**Title 37, Code of Federal Regulations, 5.11 & 5.15**

**GRANTED**

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 36 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Office of Export Administration, Department of Commerce (15 CFR 370.10 (j)); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

**NOT GRANTED**

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15 (b).

**PLEASE NOTE the following information about the Filing Receipt:**

- The articles such as "a," "an" and "the" are not included as the first words in the title of an application. They are considered to be unnecessary to the understanding of the title.
- The words "new," "improved," "improvements in" or "relating to" are not included as first words in the title of an application because a patent application, by nature, is a new idea or improvement.
- The title may be truncated if it consists of more than 600 characters (letters and spaces combined).
- The docket number allows a maximum of 25 characters.
- If your application was submitted under 37 CFR 1.10, your filing date should be the "date in" found on the Express Mail label. If there is a discrepancy, you should submit a request for a corrected Filing Receipt along with a copy of the Express Mail label showing the "date in."
- The title is recorded in sentence case.

Any corrections that may need to be done to your Filing Receipt should be directed to:

Assistant Commissioner for Patents  
Office of Initial Patent Examination  
Customer Service Center  
Washington, DC 20231

EXHIBIT F

NNM-001  
(7596/1)

The "RECEIVED" stamp of the Patent Office imprinted hereon acknowledges the filing of:

Certificate of First Class Mailing Under 37 C.F.R. 1.8 (1 pg.); Transmittal (1 pg.); Status Inquiry and Request to Correct Attorney of Record (2 pgs.); Copy of Power of Attorney by Assignee of Entire Interest, Revocation of Prior Powers and New Power of Attorney (3 pgs.); Copy of Return Receipt Postcard Date-Stamped 12/4/00 (1 pg.) and Return Receipt Postcard.

Name of Applicants: Mayes and Tyler

Intf. or Serial Number: 09/308,166

Atty: TATurano/MLBeloborodov

Date: June 13, 2001  
BELOBOM\7596\1.2115381\_1

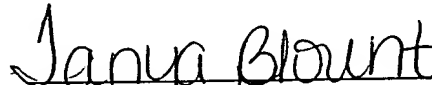


IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT(S): Mayes and Tyler  
SERIAL NO.: 09/308,166 GROUP NO.: 2754  
FILING DATE: June 25, 1999 EXAMINER: Not Yet Assigned  
TITLE: MAGNETIZABLE DEVICE

**CERTIFICATE OF FIRST CLASS MAILING UNDER 37 C.F.R. 1.8**

I hereby certify that this correspondence, and any document(s) referred to as enclosed herein, is/are being deposited with the United States Postal Service as first class mail, postage prepaid, in an envelope addressed to the Assistant Commissioner for Patents, Washington, DC 20231 on this 13th day of June, 2001.

  
Tanya Blount

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

Submitted herewith are: Transmittal (1 pg.); Status Inquiry and Request to Correct Attorney of Record (2 pgs.); Copy of Power of Attorney by Assignee of Entire Interest, Revocation of Prior Powers and New Power of Attorney (3 pgs.); Copy of Return Receipt Postcard date-stamped 12/4/00 (1 pg.) and Return Receipt Postcard.

# TRANSMITTAL FORM

Application Serial Number	09/308,16
Filing Date	June 25, 1999
First Named Inventor	Mayes
Group Art Unit	2754
Examiner Name	Not Yet Assigned
Attorney Docket No.	NNM-001 (7596/1)
BATCH NO. (after allowance)	Not applicable
Patent No.	Not applicable
Issue Date	Not applicable

## ENCLOSURES (check all that apply)

<input type="checkbox"/> Fee Transmittal Form <input type="checkbox"/> Check Attached <input type="checkbox"/> Copy of Fee Transmittal Form <input type="checkbox"/> Amendment/Response <input type="checkbox"/> Preliminary <input type="checkbox"/> After Final <input type="checkbox"/> Affidavits/declaration(s) <input type="checkbox"/> Letter to Official Draftsperson including Drawings [Total Sheets <input type="text"/> <input type="checkbox"/> Petition for Extension of Time <input type="checkbox"/> Information Disclosure Statement <input type="checkbox"/> Form PTO-1449 <input type="checkbox"/> Copies of IDS Citations <input type="checkbox"/> Certified Copy of Priority Document(s) <input type="checkbox"/> Sequence Listing submission <input type="checkbox"/> Paper Copy/CD <input type="checkbox"/> Computer Readable Copy <input type="checkbox"/> Statement verifying identity of above	<input type="checkbox"/> Copy of Notice to File Missing Parts of Application (PTO-1553) <input type="checkbox"/> Formal Drawing(s) <input type="checkbox"/> Request For Continued Examination (RCE) Transmittal <input type="checkbox"/> Power of Attorney (Revocation of Prior Powers) <input type="checkbox"/> Terminal Disclaimer <input type="checkbox"/> Executed Declaration and Power of Attorney for Utility or Design Patent Application <input type="checkbox"/> Small Entity Statement <input type="checkbox"/> CD(s) for large table or computer program <input type="checkbox"/> Amendment After Allowance <input type="checkbox"/> Request for Certificate of Correction <input type="checkbox"/> Certificate of Correction (in duplicate)	<input type="checkbox"/> Notice of Appeal to Board of Patent Appeals and Interferences <input type="checkbox"/> Appeal Brief (in triplicate) <input type="checkbox"/> Status Inquiry <input checked="" type="checkbox"/> Return Receipt Postcard <input checked="" type="checkbox"/> Certificate of First Class Mailing under 37 C.F.R. 1.8 <input type="checkbox"/> Certificate of Facsimile Transmission under 37 C.F.R. 1.8 <input checked="" type="checkbox"/> Additional Enclosure(s) Status Inquiry and Request to Correct Attorney of Record; Copy of Power of Attorney and Copy of Return Receipt Postcard Date-Stamped 12/4/00.
--	--	--

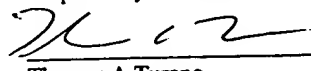
### CORRESPONDENCE ADDRESS

Direct all correspondence to: Patent Administrator  
Testa, Hurwitz & Thibault, LLP  
High Street Tower  
125 High Street  
Boston, MA 02110  
Tel. No.: (617) 248-7000  
Fax No.: (617) 248-7100

### SIGNATURE BLOCK

Date: June 13, 2001  
Reg. No. 35,722  
Tel. No.: (617) 248-7738  
Fax No.: (617) 248-7100

Respectfully submitted,

  
Thomas A. Turano  
Attorney for Applicants  
Testa, Hurwitz & Thibault, LLP  
High Street Tower  
125 High Street  
Boston, MA 02110

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

APPLICANT(S):      Mayes and Tyler  
SERIAL NO.:          09/308,166          GROUP NO.:          2754  
FILING DATE:        June 25, 1999          EXAMINER:          Not Yet Assigned  
TITLE:                MAGNETIZABLE DEVICE

Assistant Commissioner for Patents  
Washington, D.C. 20231


**STATUS INQUIRY AND REQUEST TO CORRECT ATTORNEY OF RECORD**

1.      Almost two years passed since the filing of the above-referenced application on June 25, 1999. No communication has been received from the Patent and Trademark Office indicating action on this application to date.
2.      On June 12, 2001, a representative of the undersigned contacted the Customer Service Desk for the Technology Center 2700, and was advised by Mr. Tim Vo that, according to the records of the U.S. Patent and Trademark Office ("USPTO"), the attorneys of record for the above-referenced appication were Beyer & Weaver, LLP of Mountain View, CA.
3.      On November 15, 2000, Applicants revoked the powers of attorney previously given, and appointed the attorneys and agents of the law firm of Testa, Hurwitz & Thibeault, LLP to prosecute the above-referenced application. Revocation of Prior Powers and New Power of Attorney form was received by the USPTO on December 4, 2000. A copy of the form and the stamped return receipt postcard are attached hereto.
4.      Kindly update the records of the USPTO accordingly, and advise the undersigned of the present status of this application. **A stamped return-addressed envelope is provided.**

Respectfully submitted,

Date: June 13, 2001  
Reg. No. 35,722

Tel. No.: (617) 248-7738  
Fax No.: (617) 248-7100

  
\_\_\_\_\_  
Thomas A. Turano  
Attorney for Applicants  
Testa, Hurwitz, & Thibault, LLP  
High Street Tower  
125 High Street  
Boston, Massachusetts 02110

BELOBOM\7596\1.2114646



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT(S): Mayes and Tyler  
SERIAL NO.: 09/308.166 GROUP NO.: 2754  
FILED: June 25, 1999 EXAMINER: not yet assigned  
TITLE: MAGNETIZABLE DEVICE

Assistant Commissioner for Patents  
Washington, D.C. 20231

**POWER OF ATTORNEY BY ASSIGNEE OF ENTIRE INTEREST**  
**REVOCATION OF PRIOR POWERS AND NEW POWER OF ATTORNEY**

Sir:

As assignee of record of the entire interest of the above-identified

- ☒ application,  
☐ patent,

all powers of attorney previously given are hereby revoked and  
the following attorneys and/or agents are hereby appointed to prosecute and transact all business  
in the Patent and Trademark Office connected therewith.

Steven M. Bauer	Reg. No. 31,481
John V. Bianco	Reg. No. 36,748
Isabelle A.S. Blundell	Reg. No. 43,321
Maureen A. Bresnahan	Reg. No. 44,559
Michael H. Brodowski	Reg. No. 41,640
Jennifer A. Camacho	Reg. No. 43,526
Joseph A. Capraro, Jr.	Reg. No. 36,471
John J. Cotter	Reg. No. 38,116
John V. Forcier	Reg. No. 42,545
Steven J. Frank	Reg. No. 33,497
Brian M. Gaff	Reg. No. 44,691
Michael J. Giannetta	Reg. No. 42,574
Duncan A. Greenhalgh	Reg. No. 38,678
William G. Guerin	Reg. No. 41,047
Jonathan A. Harris	Reg. No. 44,744
Ira Heffan	Reg. No. 41,059
Danielle L. Herritt	Reg. No. 43,670
Douglas J. Kline	Reg. No. 35,574
John D. Lanza	Reg. No. 40,060
Kurt W. Lockwood	Reg. No. 40,704

Thomas C. Meyers	Reg. No. 36,989
Joseph B. Milstein	Reg. No. 42,897
David G. Miranda	Reg. No. 42,898
Ronda P. Moore	Reg. No. 44,244
Indranil Mukerji	Reg. No. P-46,944
Edmund R. Pitcher	Reg. No. 27,829
Michael A. Rodriguez	Reg. No. 41,274
Jamie H. Rose	Reg. No. 45,054
R. Stephen Rosenholm	Reg. No. P-45,283
Christopher W. Stamos	Reg. No. 35,370
Diana M. Steel	Reg. No. 43,153
Joseph P. Sullivan	Reg. No. 45,349
Robert J. Tosti	Reg. No. 35,393
Thomas A. Turano	Reg. No. 35,722
Michael J. Twomey	Reg. No. 38,349
Christine C. Vito	Reg. No. 39,061
Patrick R.H. Waller	Reg. No. 41,418
Daniel A. Wilson	Reg. No. 45,508
Yin P. Zhang	Reg. No. 44,372

☒ Attached as part of this power of attorney is the authorization of the above-named attorneys/agents to accept and follow instructions from my representatives.

Assignee also hereby grants additional Powers of Attorney to the attorneys and/or agents named above to file and prosecute foreign national patent applications in any and all countries of the world, a regional patent application under the European Patent Convention and/or an international application under the Patent Cooperation Treaty based upon the above-identified application, including a power to meet all designated office requirements for designated states.

All future correspondence should be sent to:

Patent Administrator  
Testa, Hurwitz & Thibault, LLP  
High Street Tower  
125 High Street  
Boston, MA 02110

The assignee of record of the entire interest of the above-identified

☒ application

☐ patent

is

Name of assignee of entire interest

*Nanomagnetics Limited*

☐ Recorded in PTO on

Reel No.:

Frame No.:

☐ Recorded herewith

Dated: Nov 15<sup>th</sup>, 2000

Respectfully submitted,



Eric L. Mayes

Technical Director

Nanomagnetics Limited

9 The Circus, Bath BA1 2EW, Great Britain

The "RECEIVED" stamp of Patent Office imprinted hereon acknowledges the filing of:

Transmittal Form (1 pg); Preliminary Amendment (4 pgs); Power of Attorney (3 pgs);  
Assignment (1 pg.) and Notice of Recordation of Assignment (1 pg) filed under Express Mail  
Label No. EL702626437.

Name of Applicant: Mayes and Tyler

Intf. or Serial Number: 09/308,166

Atty: Thomas C. Meyers/Mark Beloborodov

Date: December 4, 2000



NNM-001  
(7596/1)

The "RECEIVED" stamp of the Patent Office imprinted hereon acknowledges the filing of:

Certificate of First Class Mailing Under 37 C.F.R. 1.8 (1 pg.); Transmittal (1 pg.); Status Inquiry and Request to Correct Attorney of Record (2 pgs.); Copy of Power of Attorney by Assignee of Entire Interest, Revocation of Prior Powers and New Power of Attorney (3 pgs.); Copy of Return Receipt Postcard Date-Stamped 12/4/00 (1 pg.) and Return Receipt Postcard.

Name of Applicants: Mayes and Tyler

Intf. or Serial Number: 09/308,166

Atty: TATurano/MLBeloborodov

Date: June 13, 2001  
BELOBOM\7596\1.2115381\_1